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AUTHOR Peeck, Joan
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ABSTRACT

A study was conducted to test the findings of two earlier studies (Peeck 1974 and Pressley 1983) on the effects of occasional mismatches between verbal and pictorial content in children's retention of illustrated prose. While the Peeck study indicated a considerable impact of mismatched pictures, the Pressley study indicated that with some procedural changes in the design of mismatched picture-experimentation, no reduction of children's retention of prose will occur. In the present study, subjects (53 fifth grade children) were assigned to one of four conditions defined by the presence or absence of illustrations. The text was a 19-page story with 37 illustrations. Subjects were told to select the alternative corresponding to the text each time they came across a question dealing with a mismatched illustration. Retention was measured either by a multiple-choice test or by cued recall. Results suggest substantial effects of mismatched pictures, especially when retention is assessed after a delay. Effects are due to the forgetting of initially detected inconsistencies, confusion of the origin (verbal or pictorial) of retained information, and an increased tendency to respond with information provided by pictures rather than by text. (EL)

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Effects of Mismatched Pictures on
Retention of Illustrated Prose

Joan Peeck

University of Utrecht

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Mailing address: Psychologisch Laboratorium
Rijksuniversiteit Utrecht
Varkenmarkt 2
3511 BZ Utrecht
Netherlands

Two experiments were conducted to study the effects of occasional mismatches between verbal and pictorial content in children's retention of illustrated prose. The text was a 19-^a/₈ page story with 37 illustrations; retention was measured by multiple-choice test (Experiment 1) or cued recall (Experiment 2). Results suggest substantial effects of mismatched pictures, especially when retention is assessed after a delay. Effects are due to the forgetting of initially detected inconsistencies, confusion of the origin (verbal or pictorial) of retained information, and increased tendency to respond with information provided by pictures rather than text.

Effects of mismatched pictures on retention of illustrated prose

In the past decade a considerable growth in research in the effects of text illustration can be observed (for a review, see Levie & Lentz, 1982). One of the conclusions from these studies is that "learning information in the text that is also shown in the pictures will be facilitated" (Levie & Lentz, 1982, p. 225) - provided the text information is depicted correctly, one should perhaps add. For it is less clear what will happen when the information in the pictures is more or less inconsistent with the prose content. A study I conducted some years ago (Peeck, 1974) seemed to indicate a considerable impact of such 'mismatched' pictures. In that study, fourth-graders read either an illustrated or un-illustrated Rupert Bear story and -after varying intervals- were tested for retention. The reading material was a 19-page booklet with, in the illustrated condition, two drawings on each page and a 70-90 word text under each drawing. The 45-item multiple choice test (4 alternatives) contained questions on information provided by text or pictures only, and on text information that was illustrated either congruously or incongruously. Items dealing with mismatched illustration contained both an alternative (T) corresponding to the text and an alternative (P) corresponding to the picture; subjects could therefore base their response on either information from the text or on information provided by the picture. The occasional mismatches were included "to gain some insight into the relative contribution of text and pictures on recall" (Peeck, 1974, p. 881). Accordingly, the children were not informed of the occurrence of mismatches, and, at the test, left free to choose the alternative they thought best. On the mismatch items of the posttest children in the illustrated condition tended to select P alternatives more frequently than T alternatives; furthermore, they selected somewhat fewer T alternatives and, of course, far more P alternatives than children who had not seen the illustrations. Similar results were obtained by Willows (1979) in a study with much shorter reading passages.

The pejorative effect of mismatched pictures on memory for prose, suggested by these studies, has recently been questioned by Pressley and his associates (Pressley, Levin, Pigott, LeComte & Hope, 1983). In their paper Pressley et al. indicate that with some procedural changes in the design of mismatched-picture experimentation, no reduction of children's

retention of prose will occur. More particularly, using cued recall measures instead of recognition tests, and warning subjects at testing to recall only from the text and not from the pictures, appeared sufficient to neutralize interference effects from the mismatched pictures.

The present experiments were conducted to test the generality of these findings, and to see whether pejorative effects can likewise be reduced when procedural changes are introduced into the design of the original Peeck (1974) study. In the first experiment children read either the illustrated or unillustrated Rupert Bear story, and took the original multiple-choice test either immediately or after 4 days. In comparison to the 1974 study, the main procedural difference was that, at testing, subjects in the illustrated condition were told to select the alternative corresponding to the text each time they were coming across a question dealing with mismatched illustration. This procedure was chosen to enable separate analysis of possible interference effects for identified (or rather: reported) and for not-identified inconsistencies. Unlike the experiments by Pressley et al., delayed-retention measures were included because previous experiments (Peeck, 1983) indicated that after a delay subjects may well forget whether information originated from the text or from the pictures. Experiment 2 was similar to Experiment 1, but this time cued recall instead of recognition measures were used.

Method Experiment 1

Materials In the illustrated text condition, the learning material was a 19-page booklet containing a Rupert Bear strip cartoon. There were two drawings on each page with a 70-90 word text under each drawing. The text was so constructed that pictures plus text contained four categories of information: (a) exclusively provided by text (T); (b) exclusively provided by pictures (P); (c) congruously provided by text and pictures (P+T); and (d) incongruously presented by text and pictures (P&T). The last category contained, on the one hand, instances where, though text and accompanying picture did not agree, the information provided by the one was not logically incompatible with information given by the other; for example, on one occasion it is stated in the text that Rupert Bear is walking through a wood, whereas the accompanying picture shows him walking along a country road. The data seem contradictory, but may, with a little good will, be combined; after all, text and picture may deal with different instances of Rupert's behavior. In some other cases, however, the information in the picture was logically

virtually irreconcilable with the content of the text; for example, when, according to the story, a certain character (the hippopotamus) performs a unique action (he pulls the tablecloth off a laid table), whereas the accompanying picture shows the same action being executed by someone else (the king).

The multiple-choice test consisted of 39 items, each with 4 alternatives, covering the information categories specified above. There were 8 T questions, 9 P questions, 8 P+T questions, and 14 PxT questions. The 14 PxT questions contained both an alternative corresponding to the text and an alternative corresponding to the pictures. The test contained one PxT question less than the original Feeck (1974) study; this particular item was used to clarify the somewhat complicated test instruction in the experimental condition.

For the unillustrated text condition, a similar 19-page booklet was made, consisting of only the units of the Kupert Bear story.

Subjects Subjects were 53 children (11-12 years old) from two fifth grades. Within each class subjects were randomly assigned to one of four conditions defined by the presence or absence of illustrations, and the time of testing: immediately or after four days.

Procedure The subjects were tested in groups of two, homogeneous as to the condition. They were asked to read the story at their own rate, and it was stressed that there was no need to hurry. No mention was made of the test that would follow the reading, nor were the experimental subjects informed of the occasional mismatches between pictures and text.

At testing the children in the experimental condition were told of the occurrence of mismatches in the learning material. As an example, a copy of one of the drawings and its accompanying passage was shown, and the inconsistency involved pointed out. The children were then instructed that, when they came across a test item that referred to a mismatch, they should (a) put a cross next to the question, and (b) select the response alternative that corresponded to what they had read in the text. This procedure was illustrated on the basis of the example presented earlier. The children were also told that, though mismatch questions did occur, most questions would be normal. When the children had completed the test they were asked to look again at the mismatch items they had identified, and to try and select for each question the alternative that corresponded with the picture content. For this purpose they were given a pen of a different color, so that their first and second responses could be identified. Finally, the experimenter went through all the non-detected inconsistency questions and asked subject (a) to indicate the modality of his or her answer, i.e. whether

the response was based on the picture or on the text, and (b) to try and select (and to guess, if necessary) the other possible response. (By mistake, modality identifications were not collected from one subject at the immediate test, and from three subjects at the delayed test). The multiple choice principle was explained to the children in the control condition using the same story passage as was used in the experimental condition - of course without the accompanying picture. Furthermore, subjects were told that some other children had seen pictures with the story, and that the test contained some questions that could only be answered on the basis of the pictures; they were asked to guess the responses, whenever they came across a picture question.

Method Experiment 2

Experiment 2 differed from Experiment 1 mainly in that a 27-item cued recall test was used, consisting of questions dealing with information from text only (T; 7 items), from correctly illustrated text (P+T; 7 items), and from incorrectly illustrated text (PxT; 13 items). Since it was not always possible to change a multiple-choice PxT question into a satisfactory cued-recall one, the original text was occasionally changed to repair old mismatches and to create new ones. Thus, the set of inconsistencies covered by the PxT questions in Experiment 2 was not identical to the set of inconsistencies used in Experiment 1. The subjects were 10-12 years old children of two schools who were randomly assigned to the experimental or control condition. The children in one school were tested immediately after they had read the text, whereas for the children in the other school the test came after a week. The children were tested in groups of 3 to 4. The procedure was the same as in Experiment 1. The children read the text with no reference being made to the recall test, nor, in the illustrated-text condition, to the occurrence of occasional mismatches. At the test the children in the experimental condition were told that whenever they came across a mismatch question, they should mark the question and proceed to give the answer provided by the text. For organizational reasons, they were not asked to indicate the modality of their answers to the unidentified mismatch items. They were, however, asked to try and provide second, other-modality answers for all 13 questions that dealt with inconsistencies.

Results

Experiment 1

PxT Questions; selection of T and P alternatives The mean number of mismatch questions identified at the immediate test by subjects in the experimental

inconsistency. After marking these items the subjects selected the T alternative in 60% of all cases (see Table 1), while 29% of their choices were P alternatives; the mean percentages for subjects identifying at least one mismatch item were 46% and 24%, respectively. At first sight, this seems to indicate a considerable influence of the mismatch illustrations: even though subjects were emphatically instructed to select the text alternative when a mismatch item was spotted, almost 30% of their answers were still derived from the illustrations.

As can be seen in Table 1, however, in the control condition too a good deal of P response selection occurred (21%), while the percentage of T alternatives amounted to 61% - almost identical therefore, to the 60% reported above. In this respect, it should be noted that these comparisons are somewhat biased: the percentages in the control condition refer to all PxT questions, whereas the identified PxT questions in the experimental condition form only a subset of that category. This subset is not only small, but also covers information that - because of the inconsistency involved - probably drew special attention when subjects read the story.

As Table 1 shows, for the remaining, unidentified PxT questions in the experimental condition a somewhat different pattern of results was obtained. Again in comparison with the PxT results in the control condition, experimental subjects tended to select fewer T alternatives, $t(22) = 1.34$, $p < .20$, and significantly more P alternatives, $t(22) = 2.73$, $p < .05$. The effect of the mismatch pictures may also be expressed by the mean proportion of T alternatives in the total number of T and P alternatives (T/T+P): .56 in the experimental condition, and .73 in the control condition, $t(22) = 2.20$, $p < .05$.

At the delayed test the detection of mismatch questions had dropped to a mean number of 1.20, with 9 out of 15 subjects identifying at least one item. As Table 1 shows, the percentages of subsequently selected T and P responses were, in order, 44% and 22%, with, for subjects detecting at least one question, mean percentages of 39% and 12%, respectively. Once again, this pattern is very similar to what was obtained in the control group: 45% T, and 30% P alternatives.

On the unidentified PxT questions, however, the impact of the pictorial information was even more pronounced than at the immediate test. The mean proportion of T alternatives on the total number of T and P responses was now only .42 against .60 in the control condition, $t(27) = 2.98$, $p < .01$. Experimental subjects again tended to select fewer T alternatives than controls, $t(27) = 1.46$, $p = .15$, and significantly more P responses, $t(27) = 4.10$, $p < .001$.

Second-response selection Table 2 presents the percentages of correctly

selected second answers on PxT questions, given a first correct (I or P) answer. As can be seen in the Table, for the identified mismatch questions the conditional probability of a correct second response was generally high at both the immediate and delayed test. More interesting, however, is the high incidence of correct second answers for the unidentified mismatch items - at both tests well above the chance level - which suggests the availability of both the T and P alternatives in a considerable number of cases.

Memory for modality Modality identification scores were computed separately for correctly selected T and P alternatives on the PxT questions. At the immediate test, memory for modality was good for both T and P alternatives, 78% and 76%, respectively, with 20% picture-modality assigned to T responses, and 11% text-modality assigned to P alternatives. (The remaining percentages represent omissions or P+T assignments). At the delayed test, memory for modality had deteriorated considerably: for T and P alternatives, respectively, 65% and 56% in the correct modality, 33% and 39% in the incorrect one.

T, P and P+T questions Table 3 shows the results for questions dealing with unillustrated (T) and correctly illustrated (P+T) text content, and for questions on information presented by pictures only (P). A 2x2 (Time of test x Condition) analysis of variance of text-only items showed a significant effect for Time of test, $F(1,49) = 21.74$, $p < .001$, but not for Condition, $p < .30$, nor for the interaction Time of test x Condition. Analysis of variance also indicated a significant time of test effect for the P+T questions, $F(1,49) = 14.97$, $p < .001$, but in this case the conditions were also found to differ significantly, $F(1,49) = 5.07$, $p < .05$; the interaction was not significant ($F < 1.0$). From Table 1 it can be seen that on these questions the experimental subjects outperformed the children who had read the text without illustrations, while in both conditions performance deteriorated after a delay. Finally, as could be expected, picture-only questions were answered correctly significantly more often in the experimental than in the control condition, $F(1,49) = 18.79$, $p < .001$, while both the time of test effect, and the interaction just reached significance, $F(1,49) = 4.16$, and $F(1,49) = 4.42$, respectively, p 's $< .05$. The interaction is due to the obvious absence of a time of test effect in the performance of the control condition. The results for the T, P and P+T questions thus confirm the general conclusions of earlier research (see Levie & Lentz, 1982).

Experiment 2

PxT questions; recall of T and P information The mean number of identified mismatch questions at the immediate test was 2.71, with 12 of the 14 children

detecting at least one PxT question. As can be seen from Table 1, on the identified mismatch items subjects subsequently produced 71% answers based on the text, and only 5% answers based on pictorial information (the mean percentage for subjects identifying at least one PxT question being 85% and 7%, respectively). Subjects were thus very much capable of coming up with the required T response, without any interference from the pictorial information. The performance is also clearly superior to the scores obtained by the controls: 41% T responses, and 10% P answers.¹

A rather different picture, however, emerges from the remaining, undetected PxT questions (see Table 1). On these items, subjects gave more P answers (35%) than T answers (32%), the mean proportion $T/(T+P)$ being significantly lower than for controls, .44 versus .77, $t(26) = 3.31$, $p < .005$. In comparison to control subjects, experimental subjects tended to give fewer T answers, $t(26) = 1.11$, $p < .30$, and far more P answers, $t(26) = 5.38$, $p < .001$.

As in Experiment 1, at the delayed test the mean number of detected mismatch questions had dropped to 1.43, with 6 of the 14 subjects identifying at least one PxT item. As Table 1 shows, subjects were also subsequently much less capable of coming up with the required information from the text; they were, in fact, as likely to produce an answer derived from the pictures as they were to produce a T response. As Table 1 indicates, comparison of this response pattern with the one obtained in the control condition does not render a ready evaluation of the results: control subjects gave proportionally fewer T answers (12%), but also fewer P responses (10%, as on the immediate test).

As in Experiment 1, the contribution of P responses on the unidentified PxT questions had increased considerably at the delayed test. While the percentage of correctly recalled textual information was about the same in the experimental and control condition ($t(26) = .10$), experimental subjects produced far more P responses than controls, $t(26) = 3.59$, $p < .001$. The impact of the pictures on subjects' recall is also expressed by the modest proportion of T responses in the total number of T and P answers: .29 against .56 in the control condition, $t(26) = 2.56$, $p < .05$.

Second responses The percentages of correct second answers on PxT questions, given a first correct (T or P) answer are presented in Table 2. As Table 2 indicates, for identified PxT questions the conditional probability of a second correct answer was almost 100% at the immediate test, and still substantial (63%) when testing was delayed for a week. For the unidentified PxT items, however, the level of conditional second answer recall was quite considerable too, with, interestingly, even a somewhat higher level at the

delayed test (29%) in comparison to the immediate one (20%). Thus, as in Experiment 1, both P and T responses appeared to be available in a substantial number of cases.

T and P+T questions The results for the two remaining categories of test questions, dealing with unillustrated (T), and with correctly illustrated (P+T) text content are presented in Table 3. Since different schools were used for the immediate and delayed condition, the data were separately analysed for each time of test. In accordance with the results in Experiment 1, experimental subjects performed significantly better than controls on P+T questions, but not on T questions: for the immediate test, in order, $t(26) = 3.56$, $p < .001$, and $t(26) = .23$, ns, for the delayed test $t(26) = 2.32$, $p < .05$, and $t(26) = .31$, ns.

Discussion

To what extent do the results of this study help to assess the effects of mismatched pictures on the retention of illustrated prose? On first sight, they seem to support the findings by Pressley et al., (1983) rather nicely. Performance on the identified mismatch questions at the immediate test is very much as can be predicted from Pressley et al. : When specifically instructed to do so subjects were generally capable of responding with the information provided by the text. It is true that on multiple choice items quite a few responses were derived from the pictures, but a similar level of P responding was found in the control condition, whereas with cued recall questions hardly any interference from the mismatch illustrations occurred - precisely as suggested by Pressley and his associates.

Performance on the identified PxT questions at the delayed test is somewhat harder to assess: With multiple choice questions the results are still very much in accordance with the findings by Pressley et al., but with cued recall questions the results are less clear. Interpretation of the level of T and P responding is, however, difficult because of the low level of mismatch identification.

As for the unidentified PxT questions, again the experimental subjects do not differ significantly from controls in their level of recall of textual information. A small and rather consistent pejorative effect may be observed though, but it never exceeds the .15 level of significance.

While these results provide support for the conclusions by Pressley et al., there are several indications in the data that suggest that the effects of mismatched illustrations are a good deal more complex than is apparent from the Pressley study.

Though for unidentified PxT questions, the level of textual recall was not affected significantly in the experimental conditions, a strong impact of the mismatch pictures manifested itself in the level of pictorial responses. While at the immediate test a substantial proportion of subjects' correct responses still came from textual information, at the delayed test picture responses outnumbered textual responses by far. For the assessment of the effect of mismatched pictures on retention of illustrated prose, this is an important outcome. It indicates that, when children are questioned about their memory of a text with occasional mismatched illustrations, much of what they remember is derived from the pictures. This appears to occur irrespective of the type of test used, and to increase substantially as testing is delayed.

There is, however, an important counterargument that must be dealt with before a conclusion of this kind can be drawn. It could be argued that it is not valid to speak of 'unidentified PxT questions', because the very fact that the items were not identified could very well indicate that information from only one modality was encoded: at that particular point in the story, subject either just read the text or looked at the pertinent picture element and, when questioned about it afterwards, responded with a T or P answer according to what he or she had stored.

In a number of cases this will certainly have occurred, but there are several indications that justify the assumption that quite often both elements had been encoded. One indication, of course, is the availability of second answers on unidentified mismatch questions which, though less pronounced than for the identified PxT questions, was nevertheless substantial at both the immediate and delayed test.

Another indication may be derived from the shift in the proportion of T and P responses on unidentified PxT items from the immediate to the delayed test. Even though systematic encoding differences are unlikely to have occurred between subjects in the immediate and in the delayed condition, the latter were much more inclined to respond with pictorial information than the former. This suggests that, immediately after reading the text, subjects will often have had two answers available, but that in their responding they increasingly came to rely on the pictorial input. The implied coexistence of conflicting memories fits in nicely with recent findings (Christiaansen & Ochalek, 1983) on the effects of misleading information on one's memory for an event. In this respect it should be noted that in present learning material varying degrees of conflict between pictures and text were established. When dealing with mismatches

with a low degree of conflict, subjects may well have reconciled the contradictory information in the manner described earlier (see Method section; see also Baker, 1979, for an account of similar 'fix-up strategies' in a different context). In these cases, the resulting coexistence will have been a relatively peaceful one. Analysis of the individual test items, however, suggests that with more blatant mismatches too, coexistence can be found. It may further be assumed on the basis of earlier experiments (Peeck, 1983) that subjects may well have encoded conflicting information without ever becoming aware of the inconsistency involved.

There are two other arguments that may be put forward to support the notion that the effects of mismatched pictures are more complex than suggested, especially when the effects are studied after a delay. One is, that subjects apparently forget some of the mismatches they were able initially to report; ^{at} the delayed test in Experiments 1 and 2 detection of mismatches had dropped by almost 50%, even though there is no reason to assume that the subjects in these conditions had initially detected fewer inconsistencies than subjects who were tested immediately. (In fact, it is quite possible that some mismatches that were detected during the reading process, were subsequently forgotten by the time of the immediate test). The status of the mismatches in question changed accordingly from 'detected' to 'unidentified' - a category that was, as shown before, particularly affected by pictorial information.

A final argument may be derived from the modality assignment task. After a delay, subjects appear to forget on which type of information their answers were based; they tend to confuse the encoding modalities so that they may well produce picture responses while believing they originate from the text - and vice versa (cf. Peeck, 1983).

¹The number of P answers in the control group is perhaps a little surprising, but is probably due to the fact that in some cases subjects who ventured a guess, had a reasonably good chance of coming up with a P answer. There is, for example, an item that refers to an incident that occurs at a dinner party: a fight breaks out between a cake and a pudding in which, according to the text, the pudding hits the cake with a fork, whereas the illustration indicates that the pudding uses a spoon. It is quite possible that at the test a subject -without having seen the picture- just remembers that cutlery was used, and subsequently produces the (picture) response 'spoon'.

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Table 1

Proportion of selected responses in accordance with text (T) or with pictures (P) on mismatch testquestions

	Experimental condition				Control condition	
	Identified items		Unidentified items		T	P
<u>Experiment 1</u>	T	P	T	P	T	P
Immediate test	.60	.29	.50	.37	.61	.21
Delayed test	.44	.22	.36	.48	.45	.30
<u>Experiment 2</u>						
Immediate test	.79	.05	.32	.35	.41	.10
Delayed test	.20	.20	.12	.32	.12	.10

Table 2

Conditional probability of a correct second response given a correct
(P or T) first answer

test	Experiment 1		Experiment 2	
	immediate	delayed	immediate	delayed
Identified PxT	.84	.75	.94	.63
Unidentified PxT	.62	.59	.20	.29

Table 3

Mean retention and standard deviations of text content (T), picture content (P) and correctly illustrated text (P+T)

Question type		T			P		P+T	
Information provided by		Text only			Pictures only		Pictures plus text	
<u>Experiment 1</u>		N	M	SD	M	SD	M	SD
Test	Condition							
Immediate	Exp	12	6.92	0.90	6.92	1.56	5.50	1.57
	Con	12	6.50	1.09	3.25	1.09	4.50	1.00
Delayed	Exp	15	5.00	1.69	5.40	1.45	3.80	1.61
	Con	14	4.57	1.91	3.29	1.20	2.86	1.88
<u>Experiment 2</u>								
Immediate	Exp	14	4.14	1.79			5.29	1.20
	Con	14	4.00	1.52			3.57	1.34
Delayed	Exp	14	2.79	1.89			3.57	1.69
	Con	14	2.57	1.74			2.14	1.56